ALUMINUM

Project Fact Sheet

Inert Metal Anode Life in Low Temperature Aluminum Reduction Process

Benefits

- Reduction in electrical energy consumption to about 5.0 kilowatt hour (kWh) per pound of aluminum versus the prevailing average of 7.5 kWh per pound
- Potential energy cost savings of $90 million annually in the U.S. by 2010
- Reduction in consumption of non-renewable resources
- Elimination of carbon and perfluorocarbon emissions
- Elimination of the health hazards, environmental hazards and costs associated with potliner disposal
- Potential non-energy savings of $60 million annually in the U.S. by 2010 due to reduced capital and environmental costs

Applications

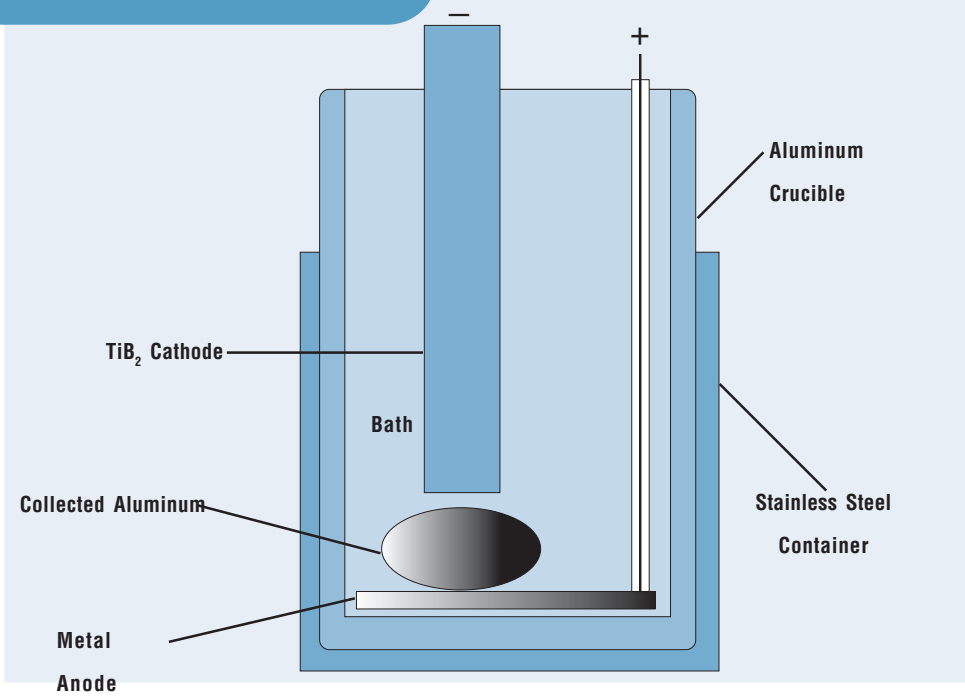
This new primary aluminum smelting technology could replace existing traditional Hall-Héroult production cells in the U.S. and could be used for new production cells.

Low-energy, carbon-free aluminum production cell will provide an alternative for primary aluminum production

The energy intensive Hall-Héroult electrolytic cell, developed over 100 years ago, is the primary process used to produce aluminum. Advances in electrolytic cell technology have lowered electrical use. However, modern cells still consume large amounts of energy and produce significant emissions.

Project partners are developing a carbon-free aluminum reduction process as a retrofit technology to the Hall-Héroult process. This innovative concept for producing primary aluminum uses a vertical electrode slurry cell with a metal alloy anode lining retrofit. The process uses a non-consumable metal alloy anode, a wetted cathode, and an electrolytic bath. The bath is kept saturated at the relatively low temperature of 750°C by means of suspending free alumina particles. This technology, once developed, will produce primary aluminum metal with lower energy intensity, lower cost, and lower environmental impact than the conventional process. Annually, over four million tons of aluminum is produced in the U.S. by smelting. This new smelting process could cut the energy need for primary aluminum production by 25 to 30 percent and significantly enhance the economic competitiveness of the aluminum industry.

300 Ampere Test Stand



The alumina crucible cell improves a typical Hall-Héroult cell by significantly reducing the voltage required.

Project Description

Goals: Produce aluminum of acceptable purity using the low temperature carbon-free process with energy consumption of about five kWh per pound.

The project consists of two primary tasks. First, laboratory scale cells will be operated to firmly establish the viability of the fundamental concepts required for a successful commercial process. Second, a pilot scale 5000-ampere (Amp) cell will be designed, constructed and operated. This task will address engineering aspects associated with scaling, such as liner fabrication, electrode configuration and design, and bath composition adjustments. If preliminary operation goes as planned, the cell will stay in operation for long-term observation.

Progress and Milestones

- Complete Long-Term Lab Scale Cell Testing (Summer 2002)
- Design 5000-Amp Pilot Cell (Summer 2002)
- Evaluate Cell Performance Against the Models (Fall 2002)
- Construct Pilot Cell (Fall 2002)
- Complete Year-Long Operation of Pilot Cell (Fall 2003)

Commercialization Plan

Once the project is proven successful, then follow-on efforts will be pursued to develop a commercial prototype in the near-term time frame.

Project Partners

Northwest Aluminum Technologies
The Dalles, OR

Electrochemical Technology Corporation
Seattle, WA

Lawrence Livermore National Laboratory
Livermore, CA

Oregon State University
Corvallis, OR

For additional information, please contact:

Project Information
Craig Brown
Northwest Aluminum Technologies
Phone: (206) 281-4550
Fax: (206) 281-0000
cbrown@nwat.net

Aluminum Program
Industrial Technologies Program
Clearinghouse
Phone: (800) 862-2086
clearinghouse@ee.doe.gov
http://www.oit.doe.gov/clearinghouse/

Please send any comments, questions, or suggestions to webmaster.oit@ee.doe.gov.

Visit our home page at www.oit.doe.gov/aluminum

Industrial Technologies Program
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

March 2003